Experimental and Clinical Observations on the Use of Pericranium in Inhibiting Bone Regrowth and Fusion*

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The usual surgical treatment of craniosynostosis involves a simple linear cranietomy followed by wrapping of the bone edges with some material to inhibit bone regrowth and fusion.\(^6,9\) Fibrin film, oxidized cellulose gauze (Oxycel), tantalum, methyl methacrylate (Lucite), rubber, and polyethylene (Polythene) have been used in an attempt to inhibit bone regrowth and fusion after linear craniectomies\(^5,12,16\). Anderson and Johnson\(^2\) described the use of Zenker’s acetate solution or 7% tincture of iodine on the surgically exposed dura mater, with favorable results. Linear craniectomy followed by the application of polyethylene and/or Zenker’s solution is now the commonly accepted treatment for this condition.\(^5,8,9,14,17\)

Complications that can occur with this method of treatment are foreign body reactions, infections, and the late possibility of neoplasm production.\(^2,8,5,12,14\)

Sorour in 1961 was the first to use pericranium interposed in craniectomies done for craniosynostosis. He used this in conjunction with an initial “four-flap” operation and, most recently, a “bilateral flap operation.”\(^11,15,16\)

This experimental study was undertaken to determine if pericranium interposed between the fracture edges inhibits bone regrowth and fusion in the first year of life in dogs.

Experimental Study

**Method.** Ten unweaned puppies 4 weeks old were used. Each animal was anesthetized with intraperitoneal Nembutal; a midline vertex scalp incision was made, and both skin edges were retracted laterally. Bilateral rectilinear bone cuts were made with a 1 mm dental disc. Pericranium was interposed between the edges of the medial limbs of the bone flap and sutured to the dura (Fig. 1). The other three limbs served as controls.

Following the preparation of the bone incisions, baseline x-ray films of the skulls were taken at suitable intervals to determine the degree of healing in the medial limb as compared to that in the control limbs. After sacrifice by an overdose of Nembutal, an en bloc cranial cap was made, which included pericranium, bone, meninges, and brain. The specimen was fixed in 10% formalin, and x-ray films of the cranial cap were taken. Following decalcification, longitudinal sections were cut from the experimental and control sites, and stained with hemotoxylin and eosin, van Gieson’s, and Gomori’s trichrome stains.

**Results.** All 10 dogs survived the operation without complications. X-ray studies indicated that the control limbs of the cranietomy (without interposed pericranium) were well healed within 2 months after surgery. Eight of the 10 experimental limbs with interposed pericranium remained radiologically patent up to 12 months following surgery. Histological examination of the operated areas showed the fibrous tissue of pericranium separating the bone edges in eight animals (Fig. 2). In early specimens (sacrificed 11 to 18 days after surgery) no bone regeneration was noted, and in the older specimens (sacrificed 2 months to 12 months after surgery) the fibrous separation of bone edges was still complete. In one case (age 3 months) small islands of bone did form between the bone edges (Fig. 3). In another case (age 6½ months) a bony connection was established at the bottom of the defect.
Clinical Study

On the basis of the excellent experimental results, pericranium was interposed between linear craniectomies in three patients. A longitudinal midline skin incision was made in the usual manner. Over the sagittal suture the pericranium was incised and dissected laterally (Fig. 1). The pericranium was then everted; parasagittal linear craniectomies were performed and the pericranium sutured to the outer layer of the dura along the lateral aspect of the craniectomy on either side. Care was taken to insure that all parts of the bone edge were covered with pericranium. There was always enough pericranium to completely cover the bone edges.

Case Reports

Case 1. A 3½-month-old child had a sagittal suture synostosis confirmed by x-ray. A pericranial procedure was done without complication. Follow-up films showed partial fusion at 7 months and complete fusion at 11 months.

Case 2. A 6-month-old child had a sagittal synostosis confirmed by x-ray. A pericranial interposition procedure was done without complication. Follow-up films showed partial fusion at 3 months and complete fusion at 9 months (Fig. 4).